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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/595,577	04/28/2006	Tomoyuki Ueno	039.0065	2964

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EXAMINER	
HOBAN, MATTHEW E	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/595,577	UENO ET AL.	
	Examiner	Art Unit	
	Matthew E. Hoban	1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *4/28/2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/26/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

Claims 1-16 are pending and presented for examination

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 6/26/2006 was filed. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-3 and 7-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-3 and 7-13 recite the use of a phase having carbon, as the principal component. It is currently unclear what the term "principal" means and what this term is related to. The carbon phase could be the principal component in terms of the role of the composite, quantity, or criticality. All of these definitions could be mutually exclusive to one another. Furthermore, it is currently ambiguous whether the term principal refers

to the carbon as the principal constituent of the phase or to the phase including carbon as the principal phase in the composite. Proper correction to the claims is necessary.

4. Claims 1, 2, 7, and 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "(with proviso that carbon is excluded)" is currently ambiguous and unclear. As written, it is currently unclear whether this phrase is part of the claims or only the applicant's intention. Furthermore, it is also unclear as to what this phrase refers. It could be describing the composite, the ceramic phase, or all of the phases aside from the "phase having carbon of 3 microns or less average crystal grain size". It is recommended that this parenthetical expression be removed from the claim language to avoid rejection. Proper correction to the claims is necessary

5. Claims 6, 8, 11, and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6, 8, 11 and 16 are outside of the scope of the claim to which they bear reference to. These four claims all recite the use of carbides, oxycarbides, composite carbides, and oxycarbonitrides in the ceramic phase of the ceramic composite. The claims to which these are dependant (1, 2, 7 and 10) all include the phrase, "with the proviso that carbon is excluded". This statement in its broadest literal meaning refers to

both pure carbon allotropes (graphite, diamond, amorphous carbon, carbon nanotubes, fullerenes, lonsdaleite) and also carbon containing ceramics, such as carbides, oxycarbides, etc. So in essence, the language of claims 1, 2, 7, and 10 states that no elemental carbon shall be included in the ceramic phase, which is in direct opposition to the language of its dependant claims. A dependant claim must further limit the claim that it depends on. For the sake of examination, the definition of "pure carbon allotropes" shall be attributed to the word carbon; however, proper correction to the claims is necessary.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3, 4, and 5 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Mishra et al in Patent Number 5,728,637.

Mishra et al teaches a nanocrystalline alumina-diamond (ceramic) composite, where the diamond precursor is 0-100 nm, and the alumina precursor is 29 nm. The metal in the powder blend comes from the oxidized metal, which is aluminum **(Relevant to Claim 1 and 6)**. The powders are mixed in a 90:10 diamond to alumina ratio and subsequently processed and finally sintered at a temperature of 1273 K (998.5 Celsius)

at a pressure of 1-1.5 GPa **(Relevant to Claim 3)**. The sintering atmosphere is unrecited. The product of sintering is an alumina-diamond with a theoretical density exceeding 99% theoretical density, meaning that the overall porosity of the sample must also be 1% or less **(Relevant to Claim 4)**. The final average grain size of the sample was 106 nm, and the sample had a hardness of 24.7 GPa **(Relevant to Claim 5)**. Samples sintered at 1098.5 Celsius reached a hardness of 32 GPa (See EXAMPLE, column 4).

3. Claims 1-6 and 13-16 rejected under 35 U.S.C. 102(b) as being clearly anticipated by Sigalas et al in Patent Number 5,690,706.

Sigalas et al teach an alumina diamond (ceramic) composite, where the diamond precursor has a mean particle size of 1 nm, and the alumina precursor has a mean particle size of 50 nm **(Relevant to Claims 1, 2, 6, and 16)**. The products were mixed and processed using 30 volume percent diamond in the mixture **(Relevant to Claim 3 and 13)**. Finally, the product was sintered at 1150 Celsius at 30 MPa in an inert atmosphere (non-oxidizing atmosphere), which resulted in a final product having a porosity of about 1 percent **(Relevant to Claim 4 and 14)**(SEE EXAMPLE 3). The hardness of this sample would be inherently greater than 10 MPa, based on the literature dealing with other diamond-alumina composites, which typically have hardnesses greater than 20 MPa **(Relevant to Claim 5 and 15)**(according to other references cited in this document as well as Mishra et al, Nanocrystalline Alumina by High Pressure Sintering, Mat. Sci. Forum Vol 225-227, pg 617-622 (1996)).

It is well settled that when a claimed composition appears to be substantially the same as a composition disclosed in the prior art, the burden is properly upon the applicant to prove by way of tangible evidence that the prior art composition does not necessarily possess characteristics attributed to the CLAIMED composition. In re Spada, 911 F.2d 705, 15 USPQ2d 1655 (Fed Cir. 1990); In re Fitzgerald, 619 F.2d 67, 205 USPQ 594 (CCPA 1980); In re Swinehart, 439 F.2d 2109, 169 USPQ 226 (CCPA 1971).

4. Claims 1-6 and 13-16 rejected under 35 U.S.C. 102(b) as being clearly anticipated by Chang et al in Patent Number 5,690,706.

Chang et al teach an alumina and multi wall nanotube (MWCNT) composite, where the alumina powder has a grain size initially of 23 nm, and the average diameter of the nanotubes is 12 nm (**Relevant to Claims 1,2,6, and 16)**. By using from 5-15 volume percent MWCNT(**Relevant to Claims 3 and 13)**, Chang was able to synthesize samples having 99% density, or conversely 1% overall porosity (**Relevant to Claims 4 and 14)** . These samples all had hardnesses greater than 14.5 MPa (**Relevant to Claims 5 and 15)**. The two powders were first processed and then sintered at 1300 Celsius at a pressure of 60 GPa in an Argon (non oxidizing) atmosphere (SEE EXAMPLE 2 and TABLE I).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 7-9 rejected under 35 U.S.C. 103(a) as being unpatentable over Mishra as applied to claims 1 and 13-16 above, in view of Tomaszewski et al.

The instant claims teach a ceramic composite composed of a phase having carbon of 3 microns or less average crystal grain size, which is made from a

powder blend of a ceramic powder having a particle size of 3 microns or less where the powder includes a ceramic of Al, Si, Ti, Zr Hg, V, Nb, Ta, Cr, Mo, or W. The blend also includes a metal of the same group, which does not necessarily have to be distinct from the group of oxides. This composite is sintered at a temperature between 800 and 1500 Celsius at a pressure of 200 MPa or more under a non-oxidizing atmosphere.

Mishra et al teaches a nanocrystalline alumina-diamond (ceramic) composite, where the diamond precursor is 0-100 nm, and the alumina precursor is 29 nm. The metal in the powder blend comes from the oxidized metal, which is aluminum. The powders are mixed in a 90:10 diamond to alumina ratio and subsequently processed and finally sintered at a temperature of 1273 K (998.5 Celsius) at a pressure of 1-1.5 GPa. The sintering atmosphere is unrecited. The product of sintering is an alumina-diamond with a theoretical density exceeding 99% theoretical density, meaning that the porosity of the sample must also be 1% or less. The final average grain size of the sample was 106 nm, and the sample had a hardness of 24.7 GPa. Samples sintered at 1098.5 Celsius reached a hardness of 32 GPa.

The difference between Mishra and the instant application is the fact that the instant application sinters in a non-oxidizing atmosphere, while Mishra sinters

under an unrecited atmosphere.

The level of skill in the art is at a stage where the technician or engineer making such composites would have an advanced knowledge of sintering variables and the effects that these would have on the final product. Atmosphere, sintering temperature, pressure, and particle size all have distinct effects on the characteristics of the final workpeice. It is stated in Tomaszewski et al (Journal of Materials Science Letters 7, pg 778-780 (1998)) that the sintering atmosphere has far reaching effects on the mechanical properties of alumina. Under vaccuum, the mechanical properties of the final alumina product are far superior to those obtained under an oxygen rich atmosphere.

The motivation to combine these two inventions is obvious in light of the fact that using such an atmosphere produces a far superior product, having better fracture toughness as well as higher strength. It is well known in Materials Science (at even a pre-graduate level) that strength and hardness are related; so firing under a vacuum would also increase hardness.

9. Claims 10-12 rejected under 35 U.S.C. 103(a) as being unpatentable over Mishra in view of Tomaszewski as applied to claims 7-9 above, and further in view of Sigalas in Patent Number 5,690706 and Chen et al. (2002).

The instant claims teach a ceramic composite composed of a phase having carbon of 30 nm or less average crystal grain size, which is made from a powder blend of a ceramic powder having a particle size of 30 nm or less where the powder includes a ceramic of Al, Si, Ti, Zr Hg, V, Nb, Ta, Cr, Mo, or W. The blend also includes a metal of the same group, which does not necessarily have to be distinct from the group of oxides. This composite is sintered at a temperature between 800 and 1500 Celsius at a pressure of 200 MPa or more under a non-oxidizing atmosphere.

Mishra et al in view of Tomazewski teaches a nanocrystalline alumina-diamond (ceramic) composite, where the diamond precursor is 0-100 nm, and the alumina precursor is 29 nm. Please refer to previous 35 U.S.C. 103 rejection. The metal in the powder blend comes from the oxidized metal, which is aluminum. The powders are mixed in a 90:10 diamond to alumina ratio and subsequently processed and finally sintered at a temperature of 1273 K (998.5 Celsius) at a pressure of 1-1.5 GPa. The powders would be sintered under vacuum according to Tomazewski. The product of sintering is an alumina-diamond with a theoretical density exceeding 99% theoretical density, meaning that the porosity of the sample must also be 1% or less. The final average grain size of the sample was 106 nm, and the sample had a hardness of 24.7 GPa. Samples sintered at 1098.5 Celsius reached a hardness of 32 GPa.

The difference between the claims at hand and the prior art is the crystal size of the carbon rich phase. The prior art has a crystal size of 0-100 nm, where the claims recite a size under 30 nm.

The level of skill in the art is at a stage where the technician or engineer making such composites would have an advanced knowledge of sintering variables and the effects that these would have on the final product. Atmosphere, sintering temperature, pressure, and particle size all have distinct effects on the characteristics of the final workppiece. The invention of Sigalas uses diamonds of 1 nm or less in size. This specific size range fits directly in the range recited by Mishra. Overall, It would seem obvious to use a precursor of small size to increase the density of the final workpiece. Smaller crystallite sizes in the sintered product leads to higher strength, toughness, and hardness. This is due to the fact that smaller grain sizes are inherently developed, as well as the fact that smaller crystallite powders are more compressible. The effect of particle size on the compressibility of alumina powders is clearly taught by Chen et al (Particle-size effect on the compressibility of nanocrystalline alumina, Physical review B **66**, 144101, pgs 1-4 (2002)). The application of this art makes it obvious to even a individual of low skill in the art to combine the two inventions to make a superior invention.

The motivation to combine these two inventions is obvious in light of the fact that using smaller particle sizes produces a far superior product, having better fracture toughness as well as higher strength. It is well known in Materials Science (at even a pre-graduate level) that strength and hardness are related; so firing under a vacuum would also increase hardness.

Double Patenting

Duplicate Claims

10. Applicant is advised that should claim 3 be found allowable, claim 13 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Conclusion

IN RETROSPECT: Claims 1-16 are rejected.

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Flahaut et al. Carbon nanotube-metal-oxide nanocomposites: microstructure, electrical conductivity and mechanical properties, Acta Materialia, Volume 48, Issue 14 September 1 2000.

Peigney et al, Carbon nanotubes in novel ceramic matrix nanocomposites, Ceramics International, Volume 26, Issue 6 17 July 2000, pg 677-683

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Hoban whose telephone number is (571) 270-3585. The examiner can normally be reached on Monday - Friday from 7:30 AM to 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571) 272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

VICKIE Y. KIM
SUPERVISORY PATENT EXAMINER